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### Reordering life

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**Reordering life: knowledge and control in the genomics revolution**, by Stephen Hilgartner, Cambridge, MA, MIT Press, 2017, 343pp., \$35, ISBN 9780262035866

In the late 1980s Stephen Hilgartner, now a leading STS scholar at Cornell University, started conducting anthropological work on what looked like an exciting biomedical endeavor: the mapping and sequencing of the human genome. As his interviews and observations progressed, this endeavor became the highly influential Human Genome Project (HGP). This led Hilgartner to continue his work until the publication of the complete human genome sequence in 2003, thus compiling an extensive record of notes and transcripts. The result is this book, which according to the author is both a “prospective study” of human genomics and a “methodological experiment” (p.21).

The first three chapters lay down important analytical tools. A central one is *knowledge-control regime*, a “sociotechnical arrangement that constitutes categories of agents, spaces, objects and relationships” in a given field, consequently allocating “entitlements and burdens” (p.9). Throughout the book, Hilgartner argues that during the HGP, human genomics generated a knowledge-control regime that was different from previous biomedical research, but at the same time strategically connected with the past. This regime was established by a *genomics vanguard*, a loosely connected group of people – mainly scientists – that both advocated for and led in the development of the HGP.

Chapters 4 to 6 document how different research objects and strategies were shaped by the knowledge-control regime that the HGP gradually adopted. Among them, Hilgartner analyses why the Sequence-Tagged Sites (STS) became the preferred genome mapping approach by the genomics vanguard and why maverick scientist and entrepreneur Craig Venter failed in his attempt to commercially exploit a number of short DNA sequences known as Expressed Sequence Tags (ESTs). The book also explores the emergence of the current data-sharing regime in human genomics. While the Bermuda Principles, formulated in 1996, established the immediate release of sequence information into the public domain, the Fort Lauderdale Agreement (2003) enabled the contributing sequencing centers to have first right of publication on their submissions.

For Hilgartner, this knowledge-control regime aligned with open data was eased by the transition in the number of HGP players from various laboratories to a handful of large-scale sequencing centers dubbed as the genomic G5. The form of operation of these centers led genomics to adopt a differentiated identity, given that “factory style” science “could not be instantly formed by scaling-up” the previous “cottage industry biology” (p.107). Chapter 7 analyses the competition between the G5 centers and Celera Genomics, a new company through which Venter aimed to fulfill his proprietary ambitions over the sequence data. In 2001, Celera and the G5 agreed to make their initial results available in the scientific literature, with a follow-up sequence submission in 2003. The latter year was intentionally chosen to commemorate the 50<sup>th</sup> anniversary of the elucidation of the double helix of DNA by James Watson and Francis Crick.

This commemoration leads Hilgartner to conclude that the success of the HGP was motivated by a fine balance between continuity and rupture with previous biomedical research. On one hand, the United States genome program “distinguished the HGP from ordinary biology

constituting a governing frame focused on controlling the new agents it sought to bring into being (genome centers)” (p.228). On the other hand, this new knowledge-control regime was closely aligned with molecular biology, the powerful field that had preceded genomics, to the extent that the official end of the HGP was scheduled to happen exactly half a century after the elucidation of the double helical structure of DNA.

The book thus provides a detailed and forceful account of the configuration of genomics as a field connected with, but distinctive of molecular biology. The innovative theoretical and methodological frameworks that Hilgartner proposes contribute to its originality, but also generate a number of shortcomings. Given that most of the underlying data was obtained via anthropological fieldwork, a significant number of actors and institutions have needed to be anonymized. This makes the narrative, at times, difficult to follow. In an appendix explaining his methodology, Hilgartner claims that this is the epistemic price he had to pay in order to protect his research subjects.

The concept of a *genomics vanguard* is also punctuated with tensions. This category, borrowed from political theory, enables Hilgartner to account for the leadership role that a number of people – among them the directors of the G5 sequencing centers – played in the configuration of the knowledge-control regime characteristic of genomics. However, as the book repeatedly points out, this vanguard often split into different factions. This recurrent process of breakage and re-assemblage makes the reader wonder whether what we identify with ‘the vanguard’ is just a victorious faction rather than an *a priori* or essential concept that defines genomics. Furthermore, Hilgartner’s genomics vanguard is dominantly located in the United States.

These weaknesses are nonetheless minor issues in what constitutes an enormously rich narrative, both theoretically and empirically. *Reordering Life* is a pioneering account of an achievement – the HGP – that has shaped the course of contemporary biomedicine. The passage of time has enabled Hilgartner to follow its development as an anthropologist and reflect on the HGP with historical distance. His conclusions are thus of interest to those looking at biomedicine from a multidimensional perspective.

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